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THE GROWTH OF A CONTINENTAL FAULT SYSTEM IN THE ALBORAN SEA CONSTRAINED BY GEOLOGICAL AND SEISMOLOGICAL DATA

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Plate boundaries are defined by their seismic activity. In these tectonically active areas, well-delineated faults generate large earthquakes that over time become topographic features, implying a seismic hazard. These paradigms are called into question in the Alboran Sea, which hosts a complex boundary between the Eurasia and Nubia plates. On the 25th January 2016, a magnitude Mw 6.4 submarine earthquake struck the north of the Moroccan coast, the largest event ever recorded in the Alboran Sea. The quake was preceded by an earthquake of magnitude Mw 5.1 and was followed by numerous aftershocks whose locations mainly migrated to the south. The mainshock nucleated a releasing bend of the poorly known Al-Idrissi Fault System. According to slip inversion and aftershock distribution we assume a rupture length of 18 km. We use both seismological and geological data (i.e. multi-scale bathymetric and marine seismic reflection data with a resolution comparable to the studies on land) to document Quaternary activity on the >100-km-long Al-Idrissi Fault System, the largest structure of the Trans-Alboran Shear Zone that cuts in two the prominent South Alboran Ridge thrust fault. We report evidence of left-lateral strike-slip displacement, characterize their fault segments and demonstrate that Al-Idrissi is a basement fault, source of the 2016 earthquake events. Located along a lithospheric boundary, the Al-Idrissi Fault System is a young structure. Its central segment, transpressive, developed during the Early Pliocene while the north and south

transtensional segments are of Quaternary age. All these observations suggest that the Mw 6.4 earthquake has been able to break adjacent fault segments. Thus, propagation and linkage of the Al-Idrissi Fault System with neighbouring faults might generate a greater rupture (up to Mw 7.6), increasing the potential hazard of the structure.

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ACTIVE TECTONIC STRUCTURES IN THE GULF OF CADIZ: A MULTISCALE VIEW

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The Gulf of Cadiz is located in the southwestern margin of Iberia, along the NE-SW convergence between the African – Eurasian plate boundary (3.8-5.6 mm/yr). The area has been the source of historical and instrumental earthquakes, most of them with a moderate magnitude (Mw ≈ 5.5), although large and great earthquakes also occurred in the area, such as the 1st of November 1755 Lisbon earthquake and tsunami (Mw 8.5) and the 28th February 1969 Horseshoe earthquake. Recent studies of turbidite paleoseismology in the external part of Gulf of Cadiz found that the regional recurrence interval for Great earthquakes (Mw ≥ 8) is about 1800 yr. We have investigated the Gulf of Cadiz area for more than 15 years, carrying out bathymetric, sidescan sonar, shallow and deep multichannel seismic, wide-angle seismic and sediments sampling surveys. We focus our investigations on active structures located at the external part of the Gulf of Cadiz, corresponding to two main families of active faults compatible with the current plate convergent in the region: the WNW-ESE dextral strike-slip faults (Lineaments) and the NE-SW thrusts faults. The activity of these lineaments (Lineament N and S) is demonstrated by the presence of deep (>4 km) mud volcanoes formed along the faults traces, evidence of rising deep fluids and formation of gas hydrates, as well